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The family Ungulinidae in southern Africa and Mozambique (Mollusca: Bivalvia: Lucinoidea)

by

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ABSTRACT

Nine species of the genera *Diplodonta*, *Felaniella*, *Ungulina* and *Microstagon* occur in southern Africa and Mozambique, the two latter genera being the first records from the region. Three species are previously reported endemics, another is a new record, and the remainder are here described as new. Previous records of *Diplodonta* from southern Africa were based on misidentifications or are referable to other genera or families.

New species: *Ungulina scleractinica*, *Diplodonta (Diplodonta) planissima*, *D. (Timothymnus) pseudoglobosa*, *D. (T.) pinnaculum*; *Microstagon lacrima*.

New record: *Diplodonta (Diplodonta) lateralis* E. A. Smith, 1876.

New combination: *Felaniella alfredensis* Bartsch, 1915, is transferred to *Microstagon*. *Felania whitechurchi* Turton, 1936, belongs to *Arthritica* Finlay, 1927 (family Erycinidae).

Types illustrated: Holotypes of *Diplodonta lateralis* and *Felaniella alfredensis*; syntypes of *Felania subradiata* Sowerby, 1892, and *Diplodonta (Felania) agulhasensis* Jaeckel & Thiele, 1931 (which belong to *Felaniella*).

Nomina dubia (most based on juveniles of tellinoideans): *Diplodonta africana* and *D. almo* Bartsch, 1915; *D. neptuni*, *D. thetis* and *D. proxima* Turton, 1932.

INTRODUCTION

The genera and subgenera of Ungulinidae have been defined by Chavan in Moore (1969: 514 *et sequ.*). Unfortunately, in practice, differences between the higher taxa are not always clear-cut, and it is probable that fewer will ultimately be recognised.

Although the nominate genus *Diplodonta* Bronn, 1831, has been reported from South Africa by several authors, available evidence shows that the actual material on which each one of these records is based was either misidentified or belongs to another genus or (in most cases) family. Study of the diplodontids in the Natal Museum collection demonstrates that four South African species are referable to *Diplodonta s.l.*, and another belongs to *Ungulina* Roissy, 1805, previously regarded as a solely West African/Mediterranean group. Two further taxa, *Felania subradiata* Sowerby, 1892, and *Diplodonta (Felania) agulhasensis* Jaeckel & Thiele, 1931, were referred to *Diplodonta* by Barnard (1964), but their compressed lenticular shape indicates that they are better referred to *Felaniella* Dall, 1899, as defined by Chavan in Moore (1969). These two species are included here only in order to illustrate syntypes.

The genus *Felania* Recluz, 1851, appears to be extinct within South African waters. The West African *Felania diaphana* (Gmelin, 1791), recorded by Barnard from Late Pleistocene deposits of the Cape as *Diplodonta cf. senegalensis* Reeve, 1850, was discussed by Kilburn & Tankard (1975: 207, Fig. 14). The identity of the material reported from the Agulhas Bank by Thiele & Jaeckel (1931: 60 (218)) as *Diplodonta (Felania) rosea* (Récluz, 1851) [= *Felania diaphana*] is unknown. According to the holotype in OXUM, *Felania whitechurchi* Turton (1936: 236, pl. 62, no 1649) belongs to *Arthritica* Finlay, 1927 (family Erycinidae).

I have also included in this study the genus *Microstagon* Cossmann, 1896, which is reported here for the first time from either South Africa or the Indian Ocean. *Felaniella alfredensis* Bartsch, 1915, appears to be a highly derived member of this genus.

BIOGEOGRAPHY

Most molluscs endemic to South Africa appear to have evolved as peripheral isolates of either West African or Indo-Pacific ancestors, although at the current level of knowledge, the recognition of sister species in those regions is rarely possible. Of the nine species of Ungulinidae now known to inhabit South Africa, all except one appear to be endemic. The exception is *Diplodonta lateralis* E. A. Smith, 1876, which appears to be a modern Indo-Pacific incursive, being known also from the Mascarene Islands and elsewhere in the western Indian Ocean. Of the endemic elements, at least one species appears to have vicariated from a West African incursive, namely *Ungulina scleractinica* sp. n., whose only congeners are known from that region. Its ancestors were presumably dispersed around Cape Point at some stage prior to the development of the Benguela System during the Late Miocene. The same presumably applies to the Recent *Felania diaphana* (Gmelin, 1791), which survived until the Late Pleistocene as part of the perched fauna characteristic of the early southern Cape lagoons and estuaries.

The faunal relationships of the remainder are presently unknown, in the absence of published studies on adjacent ungulinid faunas.

ABBREVIATIONS

d/l = ratio of depth (both valves together) to total length.
h/l = ratio of height (dorsal to ventral margin).
LV = left valve.
RV = right valve.
v = valve(s).
BMNH = The Natural History Museum, London.
NMSA = Natal Museum, Pietermaritzburg.
OXUM = Oxford University Museum, Oxford.
SAMC = South African Museum, Cape Town.
USNM = National Museum of Natural History, Washington , D.C.
ZMHB = Zoologisches Museum, Humboldt University, Berlin.

'Valve depth' refers to the depth (tumidity) of a single valve; 'total depth' is measured with both valves joined (i.e. approximately double valve depth).

The geographic subdivisions used here for southern Africa are not to be equated with modern political regions. For example, Transkei is used for that part of the currently recognised Eastern Cape Province situated between the Kei and Mtamvuna Rivers.

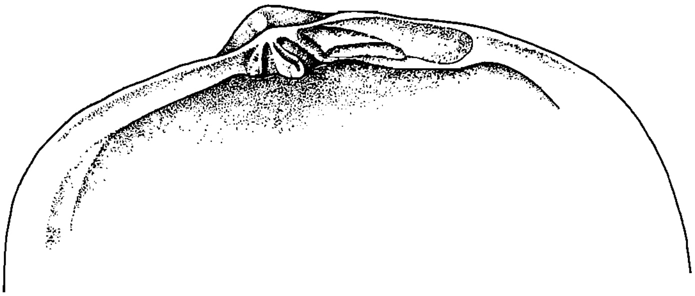


Fig. 1. Hinge of RV in *Ungulina scleractinica* sp. n.

TAXONOMY

Family Ungulinidae H. Adams & A. Adams, 1857

Ungulina de Roissy, 1805

Type species (s.d. Gray, 1847): *Ungulina rubra* Daudin in de Roissy, 1805 [= *Tellina cuneata* Spengler, 1782].

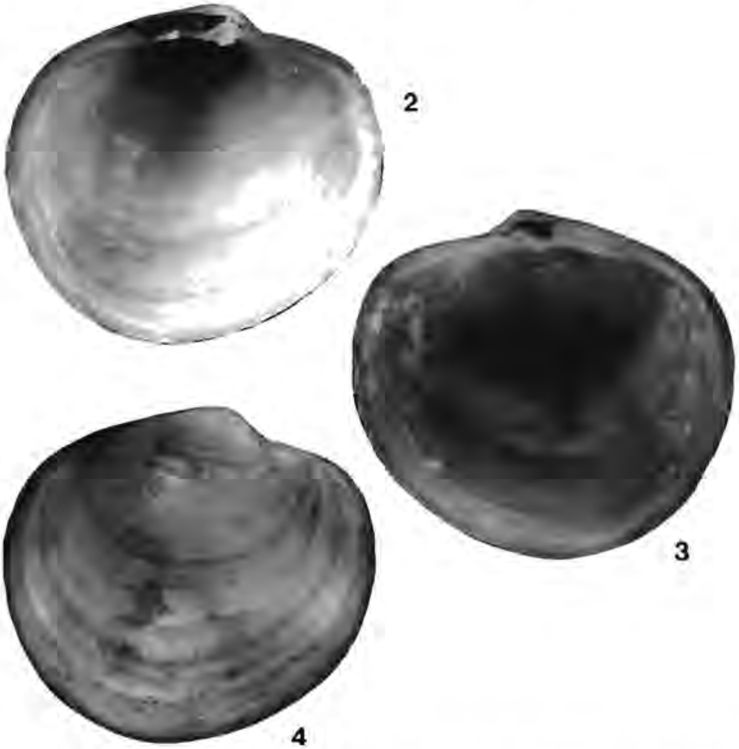
This genus differs from *Diplodonta* in its large resilium, which is situated in a deep hollow, with a sunken nymph. The range of *Ungulina* was previously thought to be restricted to the Mediterranean and West Africa, but the new species here described shows it to range into the Indo-Pacific fringe.

Ungulina scleractinica sp. n.

Figs 1–4

Diplodonta rotundata [*non*] Montagu, 1803 (as '?'); Smith, 1903: 398.

Description: Shell ovate, markedly narrower anteriorly than posteriorly, h/l 0.89–0.97, umbo low but slightly peaked, procurved and slightly anterior to median; valves shallow to moderately deep (d/l 0.48–0.82); dorsal margin anterior to beak almost straight, becoming strongly rounded anterodorsally, posterodorsal margin gently convex. Hinge plate posterior to beak equal to anterior side or shorter than it and markedly wider, being strongly expanded behind teeth to form an oblique ligament pit, basally with a declivous ligament platform but no nymph; anterior side of hinge plate widening somewhat distally, its upper edge sharp, sloping ventrally; ventral margin undulant, being strongly convex at level of anterior cardinal tooth and weakly so at posterior end of ligament; ligament short, anteriorly reaching prodissoconch, deeply sunken, brownish yellow. Hinge with 2 cardinal teeth in each valve and no laterals; RV with posterior cardinal tooth trigonal and bifid, anterior cardinal narrow, simple and projecting, in rare individuals trigonal and as strong as posterior tooth; LV with bifid, narrowly trigonal anterior cardinal and thin, oblique posterior cardinal. Exterior with fine growth lines, and sometimes an occasional growth interruption. Adductor muscle scars subequal, anterior one somewhat reniform, posterior one ovate-oblong. White with a smooth, dull, translucent, yellowish periostracal film.



Figs 2–4. *Ungulina scleractinica* sp. n. Holotype, length 9.2 mm, height 6.0 mm. **2.** LV interior. **3.** RV interior. **4.** RV exterior.

Dimensions: length 9.2 mm, height 8.3 mm, total depth 6.0 mm (holotype); 17.5 x 16.1 mm, valve depth 5.5 mm (largest paratype).

Distribution: Southern Mozambique to Kei River (probably further south), living in 8–15 m in Mozambique to Natal, nestling in dead scleractinian coral or amongst shell debris; empty shells/loose valves occur from the littoral to 90 m, and have been dredged as deep as 90–222 m off Transkei.

Type material (all NMSA): Holotype V300/T1206, Leadsman Shoal, Zululand, 8–15 m, in lumps of hermatypic scleractinian coral, D. Herbert.

Paratypes: MOZAMBIQUE: K2349/T1208, west of Santa Carolina Is., Bazaruto Archipelago, 8–10 fathoms, coral and rock, dredged P. & E. Roscoe, 5; G7110/T1211, do, 2; K2347/T1223, do, 30 ft, shell debris, dredged P. & E. Roscoe, 5; S3367/T1207, same data as holotype, 14. SOUTH AFRICA: *Zululand*: D7007/T1210, S.E. of Kosi Bay, 50 m, fine sand, 2; E6784/T1212, Leadsman Shoal, main part of coral reef, 7–11 m, D. Herbert and Natal Parks Board, 2. *Natal*: 1982/T1214, Durban, H. Burnup, 1; E6880/T1209, Aliwal Shoal (off Park Rynie), southern part, 13–18 m, D. Herbert, 1RV. *Transkei*: C4077/T1213, off Kei River, Transkei/Cape border, 222 m, coarse sand, NMDP, 7v + 1 fresh juv.

Additional material (all NMSA): MOZAMBIQUE: 15 mi. Reef, Bazaruto Island, 23 fathoms, inside coral (K2348: P. & E. Roscoe, 2 + 1v). SOUTH AFRICA: *Zululand*: S. E. of Kosi Bay, 45 m, sand, rubble (D8199: NMDP, 2v); off Jesser Point, 52–58 m, medium sand (D8497: NMDP, 1v); Raggie Reef, Leadsman Shoal, 8–12 m, mixed algal and coral reef (E7038: D. Herbert and Natal Parks Board, 1v); Leadsman Shoal, outer part, 25–28 m (E6943: D. Herbert and Natal Parks Board, juvs). *Natal*: N. E. of Umhlanga Rocks, 90 m, muddy sand, shell debris (S326: NMDP, 1v); off Amanzimtoti, 180 m, medium sand (D1227: NMDP, 1v); Shelly Beach, beach-drift (V302: R.K.). *Transkei*: off Sandy Point, 90 m, coarse sand (C4547: NMDP, 1v, worn). *Eastern Cape*: off Chalumna River, S. of East London, from commercial trawler (A1991: 1v).

LATE QUATERNARY: Mlalazi lagoon, Zululand, +2 m beach (NMSA V886: M. Cooper).

Notes: *Ungulina scleractinica* closely resembles the West African/Mediterranean *Ungulina cuneata* (Spengler, 1782) in general hinge characters, notably in the deep, broad resilium. It differs in its markedly more divergent hinge teeth – in *U. cuneata* the posterior cardinal is parallel to the anterior one, which is much more tightly bifurcate than in *U. scleractinica* – and in its more regular, ovate outline. Being a nestler, the valve exterior in *U. scleractinica* often shows slight growth irregularities, but not the massive deformities that sometimes occur in *U. cuneata*.

Juveniles are more compressed and translucent than adults, and a strong ligament pit only begins to develop at a length of 3.5 mm or more. Practically all fresh examples were collected in subtropical waters, where they nestle within dead corals. Other than a single fresh juvenile from off Kei River, only disarticulated (mainly worn) valves are known from the southern part of the species range.

An articulated specimen of *U. scleractinica* from the Burnup collection (NMSA 1982/T1214) was evidently the basis for Smith's record of *Diplodonta rotundata* (Montagu, 1803) from Durban. In this European species the ligament is shallowly sunken, on a distinct, superficial nymph (see Lamy, 1921: 336, textfigure).

Diplodonta Bronn, 1830

Type species: *Venus lupinus* Brocchi, 1814 (*non* Linné, 1758) [= *Tellina rotundata* Montagu, 1803], s.d. Herrmannsen, 1846.

As indicated above, not one of the previously published records of *Diplodonta* from South Africa appears to be valid. These records fall into two categories: misidentified species, and *nomina dubia* referable to other families.

Misidentified species include the European *Diplodonta rotundata* (Montagu, 1803), doubtfully recorded by Smith (1903) from Durban, and *Diplodonta cf. sansibarica* Jaeckel & Thiele, 1931, to which Barnard (1964: 468) referred a mixture of species. The actual specimen on which Smith's record was based is discussed above under *U. scleractinica*, and I have seen nothing from South Africa that agrees exactly with syntypes of *D. sansibarica*; the latter, examined in the ZMHB collection, are markedly higher in proportions than any species known from southern Africa.

The *nomina dubia* comprise five microscopic 'species', described by Bartsch

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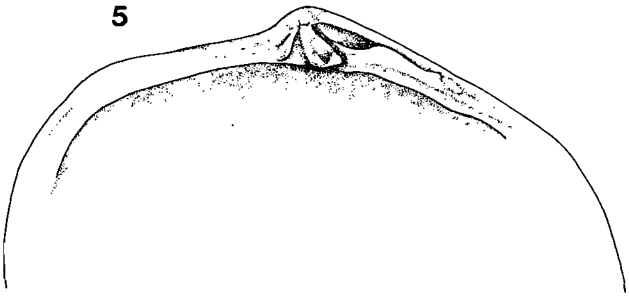

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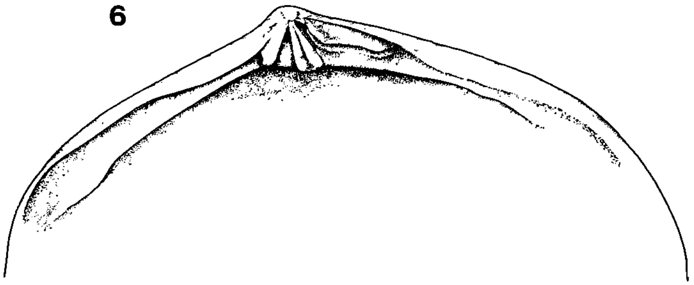

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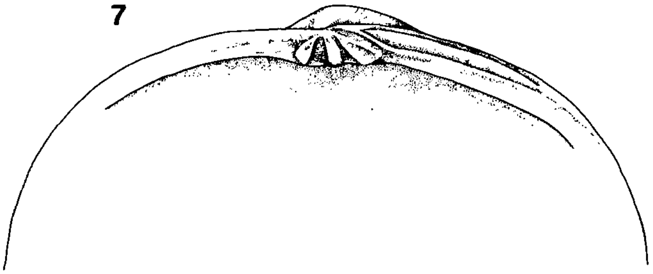

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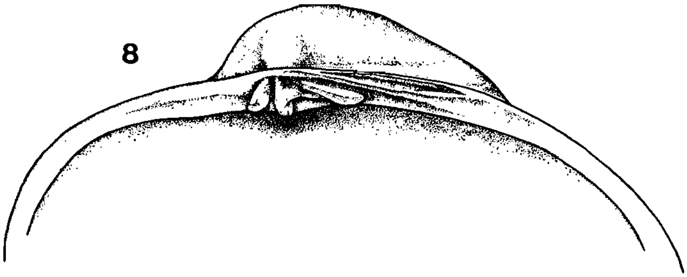
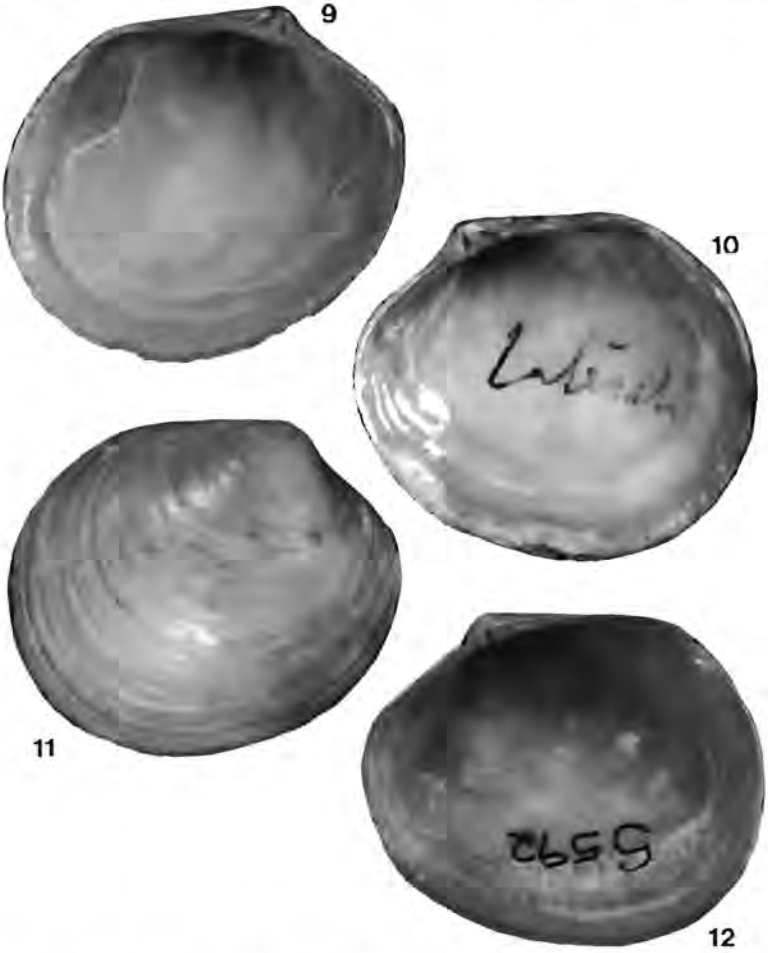


Figs 5–8. Hinge of RV in South African *Diplodonta* species (not to scale). **5**. *Diplodonta (Diplodonta) lateralis* E. A. Smith, 1876. **6**. *D. (D.) planissima* sp. n. **7**. *D. (Timothynus) pseudoglobosa* sp. n. **8**. *D. (T.) pinnaculum* sp. n.

(1915) and Turton (1932) from valves washed ashore at Port Alfred. Of these, Bartsch's names (listed without comment by Lamy 1921) appear to have been based on juvenile individuals of two species of the family Tellinidae, according to their shape and hinge characters. Thus *Diplodonta africana* Bartsch, 1915, was undoubtedly based on juveniles of a species of *Tellina* Linnaeus, 1758 (most probably *T. canonica* Salisbury, 1934), and *Diplodonta almo* Bartsch, 1915, was probably based on a juvenile *Macoma* Leach, 1819, perhaps *Macoma litoralis* (Krauss, 1848). Examination of Turton's syntypes of *Diplodonta neptuni* in OXUM indicates that they represent the same species as *D. almo*, and the broken holotype of *D. thetis* Turton, 1932, is evidently another juvenile tellinoidean. However the identity of the worn, juvenile holotype of *D. proxima* Turton, 1932, is indeterminate,



Figs 9–12. *Diplodonta (Diplodonta) lateralis* E. A. Smith, 1876. 9–11, Holotype, BMNH 1876.5.1.89, length 20.6 mm, height 18.7 mm. **9**. LV interior. **10**. RV interior. **11**. RV exterior. **12**. NMSA S592, off Glenton Reef, Zululand, 50 m, RV interior, length 21.4 mm, height 17.7 mm.

although its shape does not resemble that of any ungulinid genus; its surface, incidentally, lacks the scissulate lines that have been so crudely added to the type photograph. In summary, none of the above names are referable to the family Ungulinidae, and such *nomina dubia* need not be considered further here.

Because of low morphological diversity within the genus, species of *Diplodonta* are not always easy to differentiate by superficial examination. Apart from outline, details of the hinge plate and ligamental features are the most useful taxonomic characters; valve depth is diagnostic in some species, but in most varies individually or with age.

Key to South African species of *Diplodonta*

1 Anterodorsal margin barely sloping, convex; ligament not based on a platform or nymph; RV with posterior cardinal tooth divided into two distinctly diverging limbs 2

– Anterodorsal margin distinctly sloping, flat; ligament based on a platform or nymph; RV with posterior cardinal tooth shallowly bifid 3

2 Umbo relatively high, subtending a lunule-like hollow; slightly translucent with opaque rays at each end; left posterior lateral tooth curved .... **pinnaculum**

– Umbo lower, no such hollow; opaque;.left posterior lateral straight .... **pseudoglobosa**

3 Anterodorsal margin folded in, creating a median, longitudinal hollow, flanked by two ridges, along length of anterior side of hinge plate; valves very flattened (depth/length 0.35–0.46) .... **planissima**

– Anterodorsal margin not folded in, anterior hinge plate not as above; valves not very flattened (depth/length 0.47–0.82) .... **lateralis**

Subgenus *Diplodonta s.s.*

Diplodonta (Diplodonta) lateralis E. A. Smith, 1876

Figs 5, 9–12

Diplodonta lateralis E. A. Smith, 1876: 405; *idem*, 1877: 10, pl. 51, figs 7–7a. Type locality: Rodriguez Is.

Description: Somewhat orbicular, h/l 0.87–0.93, moderately compressed (d/l 0.47–0.63), wider posteriorly than anteriorly, anteroventral margin angularly rounded; beaks peaked, compressed, anterior to median; anterodorsal margin strongly sloping, more or less straight, sometimes slightly bevelled, posterodorsal margin less sloping and weakly convex. Hinge plate longer posteriorly than anteriorly, its ventral edge rather straight on both sides, weakly convex beneath anterior cardinal. Hinge with 2 cardinal teeth in each valve and no laterals; RV with posterior cardinal tooth trigonal and bifid, anterior cardinal narrow, simple and projecting; LV with bifid, narrowly trigonal anterior cardinal and thin, oblique posterior cardinal. Ligament long and shallow, with flange-like nymph, which becomes flattened out and ventrally inclined next to beak. Exterior with fine growth lines and periodic coarser ones. Adductor muscle scars subequal, anterior one somewhat reniform, posterior one ovate-oblong. White, periostracum not seen.

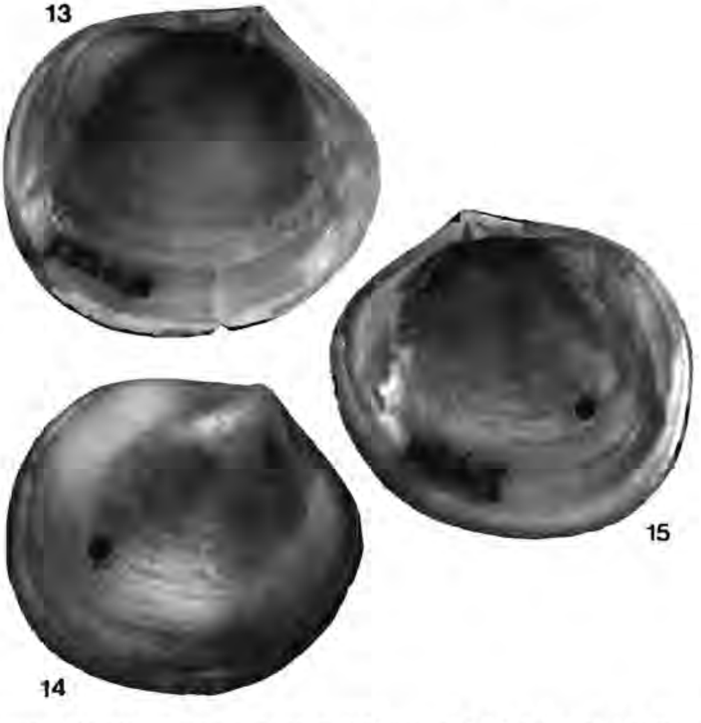
Dimensions: length 18.4 mm, height 16.7 mm, total depth 11.5 mm; 16.8 x 14.6 mm, total depth 7.9 mm.

Distribution: Mascarene Islands to Natal.

Type material: Holotype BMNH 1876.5.1.89, leg. H. H. Slater, dimensions 20.6 x 18.7 mm.

Other material examined: SOUTH AFRICA: *Zululand*: off Glenton Reef, 50 m, shell (S592: 1v). *Natal*: off Umhlanga Rocks, 12–14 fathoms (NMSA A420: R. Cruickshank, 2v); Durban beach (NMSA 7339: R. K., 3v); Durban Bay, shallow dredgings (NMSA E1132: B. J. Young, 2v); off Umlaas Canal, 75 m, muddy sand (NMSA D718: NMDP, 1v, juv.). RODRIGUEZ IS.: between Anse aux Anglais and Point Venus (NMSA K7801: D. Herbert). MAURITIUS: Ilot Fourneau lagoon, Grande Riviere Sud-Est and Pointe Sud-Ouest (NMSA K8763, L34 and K8843: R. K., D. Herbert).

Notes: The few available Natal valves agree well with the holotype and topotypic examples of the Mascarene *Diplodonta lateralis*. There is also some similarity to *D. subrotundata* Issel, 1869, of the Red Sea; however a series of that species from S. of Hurghada, Egypt (NMSA L1252: R. K.) differs in having the nymphs and ligament more sloping, terminating posteriorly in a hollow that is accommodated by ventral arching of the hinge plate margin. Specimens from the Seychelles and Shimoni, Kenya, in the BMNH collection appear to be referable to *D. lateralis*.



Figs 13–15. *Diplodonta (Diplodonta) planissima* sp. n. **13**. Paratype, NMSA E4521, LV interior, length 22.2 mm, height 20 mm. **14–15**. Holotype, NMSA D990, RV interior and exterior, length 20.0 mm, height 18.8 mm

Diplodonta (Diplodonta) planissima sp. n.

Figs 6, 13–15

Description: Somewhat orbicular, h/l 0.89–0,95, compressed (d/l 0.35–0.46), markedly wider posteriorly than anteriorly, anteroventral margin angularly rounded; beaks angularly peaked, compressed, distinctly anterior to median; anterodorsal margin strongly sloping, more or less straight, strongly folded inwards and bevelled, posterodorsal margin less sloping and straight to very slightly convex, slightly folded over. Hinge plate subequal on either side of cardinal teeth, its ventral edge rather straight to slightly sinuous on both sides, anterior cardinal tending to project slightly below margin; anterior side of hinge plate with medial hollow and double ridge, simulating laterals, formed by infolding of dorsal margin and slightly raised ventral hinge margin. Hinge with 2 cardinal teeth in each valve and no laterals; RV with posterior cardinal tooth trigonal and bifid, anterior cardinal narrow, simple and projecting; LV with bifid, narrowly trigonal anterior cardinal and thin, oblique posterior cardinal. Ligament relatively short, on thick, unguiform platform, circumscribed by an outer furrow which opens into a shallow concavity behind platform. Exterior with rather strong growth lines and periodic coarser ones. Adductor muscle scars subequal, anterior one somewhat reniform, posterior one ovate-oblong. White, periostracum not seen.

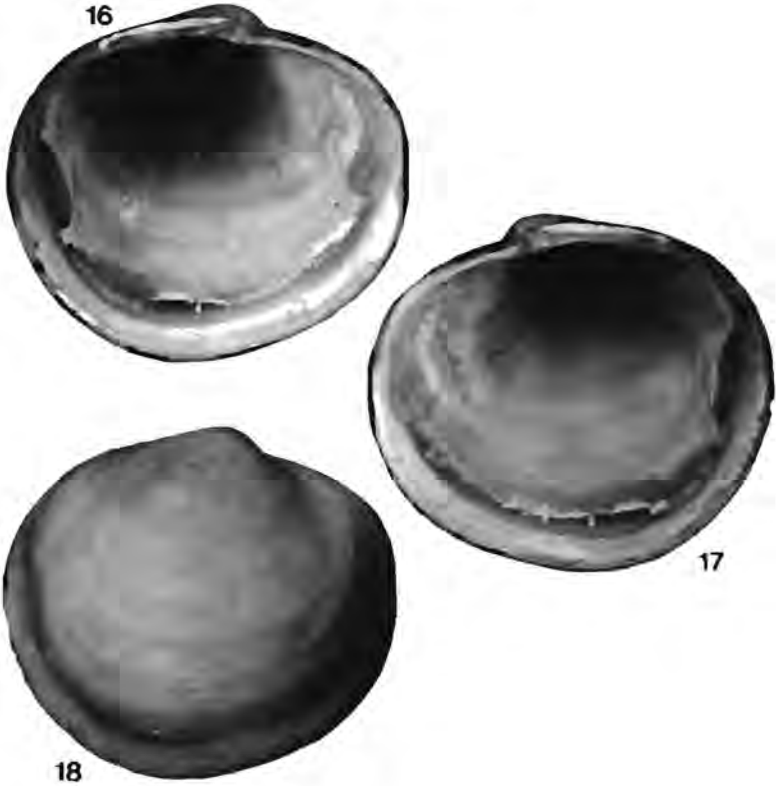
Dimensions: length 20.0 mm, height 18.8 mm, valve depth 3.5 mm (holotype); 28.0 x 24.8 mm, valve depth 5.1 mm (largest paratype).

Distribution: Central Zululand to southern Natal (slightly north of Umkomaas), 50–120 m, mainly in fine sand [only loose valves are known].

Type material (all NMSA: NMDP): Holotype D990/T1199, off Umlaas Canal (29°57.8'S; 31°01.3'E), 50 m, fine sand, RV. Paratypes: SOUTH AFRICA: *Zululand*: E4521/T1294, off Cape Vidal, 75–80 m, broken shell substratum, 1RV, 1LV; E4713/T1291, off Port Durnford, 50 m, coarse sand, 1RV; S599/T1290, off Glenton Reef, 50 m, shells, 1RV.; E9047/T1200, off Tugela Bluff, 50 m, fine sand, 1LV. *Natal*: E9618/T1292, off Sheffield Beach, 50 m, fine sand, 3RV; D3842/T1201, off Durban, 110–120 m, coarse muddy sand, 1RV; D826/T1202, off Umlaas Canal, 35–40 m, fine sand, 1LV; D1036/T1293, do, 50 m, fine sand, 1RV, 1LV; D3635/T1203, N. E. of Umgababa River, 70–80 m, fine sand, 1LV; D3578/T1204, between Umgababa and Umzimbazi Rivers, 70 m, fine sand, 2LV; C9870/T1205, between Widenham and Umkomaas, 65 m, sponge-rubble, 2RV.

Other material: SOUTH AFRICA: *Transkei*: off Port Grosvenor, 100–110 m, pebbles, some sand (NMSA C603: NMDP, 1LV, 1RV). These specimens, one of which bears a sandy concretion, were probably eroded from Quaternary beach rock.

Notes: *D. planissima* is similar to *D. lateralis* in outline, but the ligament is attached to a greatly thickened platform (instead of a flange-like nymph) and the anterior dorsal margin is characteristically folded over (the posterior margin less so), rendering the anterior side of the hinge plate not only markedly wide but with a double ridge along its length. It is also larger than *D. lateralis* and appears to have consistently flatter valves (b/l 0.35–0.46 against 0.47–0.63). Although only single valves are known, the species is a very characteristic one.



Figs 16–18. *Diplodonta (Timothynus) pseudoglobosa* sp. n., holotype, NMSA D9130, length 10.5 mm, height 8.9 mm. **16**. LV interior. **17**. RV interior, **18**. RV exterior.

A single left valve from SSW of Cape St Blaize in 101 m (NMSA V1396; NMDP) closely resembles *D. planissima* except for very minor hinge differences. In the absence of samples from the wide intervening area it cannot be assumed that they are conspecific.

The compressed umbones of *D. planissima* are suggestive of some species of *Felaniella* (e.g. *F. sericata* (Adams & Reeve, 1848)), and its generic position may need to be reviewed at some stage.

Etymology: *planissima* = very flat, Latin adjective.

Subgenus *Timothynus* Harris & Palmer, 1946

Type species: *Sphaerella bulla* Conrad, 1865, Miocene of U.S.A.

Notes: *Timothynus* differs from *Diplodonta s.s.* in the more strongly diverging posterior half of its right posterior cardinal tooth and (supposedly) in its somewhat longer adductor scars. Although Chavan (in Moore 1969: 517) treated *Timothynus* as a full genus, these differences are relatively minor, and subgeneric status appears more suitable.

Diplodonta (Timothynus) pseudoglobosa sp. n.

Figs 7, 16–18

Description: Shell oblong-oval (h/l 0.85–0.93), anteriorly slightly narrower than posteriorly; valves deep (d/l 0.60–0.75), thin; umbo low and distinctly procurved, situated slightly anterior to median; anterior dorsal margin slightly convex, scarcely so in front of beak, becoming strongly convex distally; posterior dorsal margin strongly convex. Externally with fine growth lines and periodic stronger ones. Hinge plate relatively narrow, longer posterior to beak than anteriorly; anteriorly with medial longitudinal depression, ventral edge of hinge relatively evenly curved, convex only below anterior cardinal teeth. Hinge with 2 cardinal teeth and no laterals in each valve; RV with posterior cardinal tooth split into 2 widely diverging elements, anterior cardinal thin and simple; LV with bifid, narrowly trigonal, rather high anterior cardinal tooth, posterior cardinal long, thin and oblique. Ligament in a long, shallow groove, without platform or nymph, extending anteriorly to level of prodissoconch; light brownish-yellow. Adductor muscle scars subequal, anterior one somewhat reniform, posterior one ovate-oblong. White with a smooth, dull translucent, yellowish periostracal film.

Dimensions: length 10.5 mm, height 8.9 mm, total depth 6.3 mm (holotype); largest paratype valve 16.5 x 15.3 mm, total depth 11.6 mm.

Distribution: Zululand (Kosi Bay) to western Transkei, evidently free-living in sand, mud or rubble, mainly in 45–85 m, rarely to 250 m, single valves occasionally washing ashore.

Type material (all NMSA: NMDP): Holotype D9130/T1215, off Jesser Point, Zululand (27°32.4'S; 32°41.9'E), 54 m, medium sand. Paratypes: *Zululand*: E4310/T1220, N. E. of Liefeldt's Rocks, 50 m, lithothamnion, medium sand, coral rubble, 2 + 2v (1 LV, 1 RV); S756/T1220, off Matigulu River, 70 m, coarse sand, broken shell, 1 + 10v. *Natal*: S81/T1217, off Tongaat Bluff, 70 m, mud, 2 + 1 RV; E9899/T1216, do, 85 m, muddy sand, shell debris, 1; E9954/T1222, do, 50 m, mud, 1; E9306/T977, off Sheffield Beach, 70 m, muddy sand, 9v (6 RV, 3 LV); D3548/T1218, off Durban, 75 m, sandy mud with shell rubble, 1 + 10 v (4 RV, 6 LV). *Transkei*: C4686/T976, off Qolora River, 50 m, fine sand and mud, 1 + 1 LV.

Additional material (all NMSA: NMDP, unless otherwise stated): SOUTH AFRICA: *Zululand*: S. E. of Kosi Bay, 45 m, sand, stones (S4873: 1v); off Jesser Point, 70 m, medium sand (D8439: 1v); N. E. of Liefeldt's Rocks, 50 m, medium sand, some stones (E3436: 2v); off Cape St Lucia, 76–80 m, coarse sand with mud (E5029: 4v); S. E. of Port Durnford, 50 m, coarse sand, gorgonians (E4712: 8v); do, 52 m, coarse sand (E4552: 3v); do, 98–110 m, coarse brown sand (D8099: 5v); do, 95 m, sponge rubble (E8596); off Matigulu River, 200–220 m, mud and coarse sand (E8966: 5v); off Tugela Bluff, 50 m, fine sand (E9098: 1v). *Natal*: off Mvoti River mouth, 70 m, soft mud (E9158: 1v); off Sheffield Beach, 60 m, muddy sand (E9561: 3v); S. E. of Sheffield Beach, 50–55 m, sandy mud (E5156: 8v); do, 50 m, stone slabs, broken shell (E3512: 1 juv. + 1v); off Ballito, 65 m, coarse sand (E4741: 2 juveniles + 8v); do, 60–64 m, coral rubble (E4737: 12v); off Tongaat Bluff, 90 m, sandy mud (S726: 2v); off Mgeni River mouth, 70 m, soft mud (S696: 4v); off Cooper Lighthouse, 88 m, firm grey mud (D3867: 1v); off Durban Bluff, 18–22 m, fine sand (E908: R. K., 1v); S. E. of Durban Bluff, 60 m, mud (S703: 11v); Durban (A3377: C. Connolly); off Umlaas Canal, 250 m, coarse sand (D1117: 1v, fresh); between Umgababa and Umzimbazi Rivers, 70 m, fine sand (D3579: 3v); off Amanzimtoti, 115–125 m, medium sand (D1254: 1v, fresh); between Widenham and Umkomaas, 65 m, sponge rubble (C9871: 2v); Landers Reef, off Park Rynie, 34 m, sand (S6021: D. Herbert, 1v); Shelley Beach, drift (A2312: R. K., 3v). *Transkei*: Mzamba, beach-drift (B4841, D2798: R. K.); Mbotyi, beach drift (C8225: R. K., D. Herbert, 4v); off Ubombo, 40–45 m, coarse sand, broken shell (C2461: 2v); off Mendu Point, 66 m, coarse sand and rubble (C4811: 1v); off Bulungula River, 60 m, mixed fine sand and mud (C2513: 1v); off Qolora River, 80 m, coarse sand (C3965: 19v).

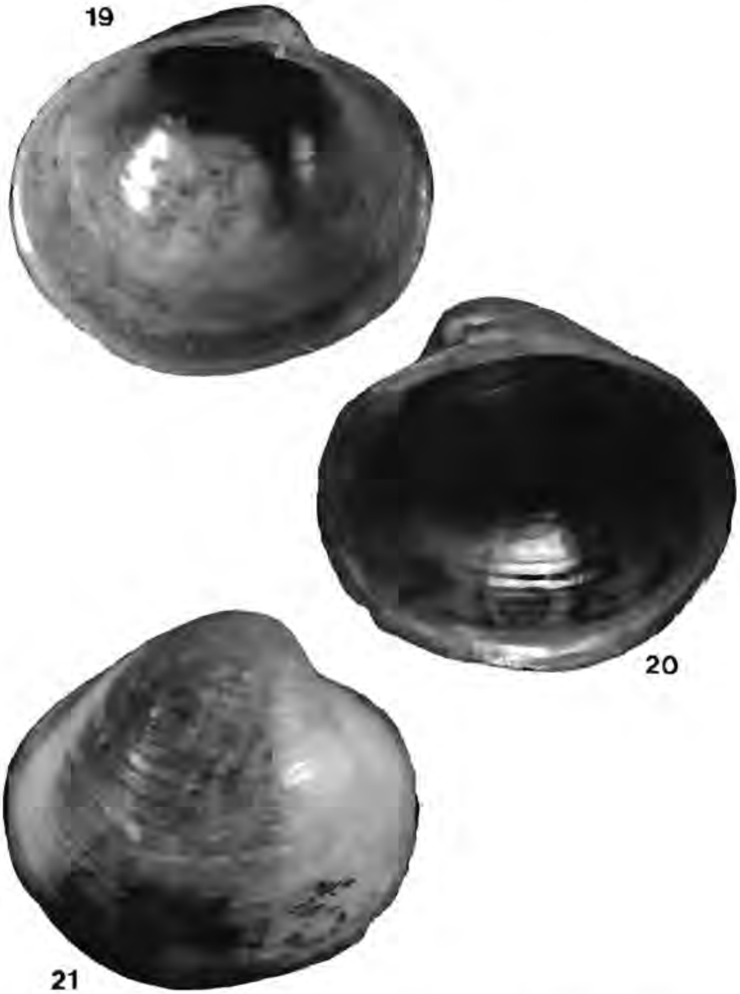
Notes: Of Indo-Pacific species, *Diplodonta (Timothynus) pseudoglobosa* most closely resembles *D. (T.) holosphaera* Melvill, 1899, of Pakistan; according to the holotype (BMNH 1899.12.18.4) and other material, the latter species is more orbicular in form, its left anterior cardinal is more widely bifurcate and the anterior part of the hinge plate is not longitudinally furrowed. *D. pseudoglobosa* is superficially very similar to *Diplodonta (Diplodonta) globosa* (Forsskål, 1775) of the Red Sea. However, in that species the posterior cardinal tooth in the RV has the trigonal, compactly bifurcate form typical of the genus (see Yaron *et al.* 1986: Fig. 9, for an illustration of lectotype and paralectotype), whereas in *D. pseudoglobosa* this tooth is almost completely split into two widely diverging elements (Fig. 7). *Diplodonta (Diplodonta) subcostata* Odhner, 1918, of Madagascar, appears to closely resemble *D. globosa*, and has a similar hinge (Odhner 1918: 9, pl. 1, figs 2–3).

Diplodonta (Timothynus) pinnaculum sp. n.

Figs 8, 19–21

Diplodonta cf. sansibarica (*non* Jaeckel & Thiele, 1931), in part; Barnard, 1964: 468.

Description: Shell oblong-oval (h/l 0.87–0.94), ends more or less equally convex; valves deep (d/l 0.67–0.76), thin, slightly translucent; umbo relatively high with strongly procurved beaks, situated about 0.3 length from anterior end, overhanging a shallow lunule-like concavity; anterior dorsal margin slightly convex, scarcely so immediately in front of beak, becoming strongly convex distally; posterior dorsal margin strongly convex. Externally with fine growth lines and periodic stronger ones. Hinge plate relatively narrow, distinctly declivous towards inner edge, much longer posterior to beak than anteriorly; anteriorly with medial longitudinal depression, ventral edge of hinge not evenly curved. Hinge with 2 cardinal teeth and no laterals in each valve; RV with posterior cardinal tooth split into 2 widely diverging elements, anterior cardinal simple, very similar to anterior element of posterior cardinal; LV with anterior cardinal bifid, narrowly trigonal, rather delicate, posterior cardinal rather long, thin, low, arcuately curved and oblique. Ligament in a long, shallow groove, without platform or nymph, not extending anteriorly as far as level of prodissoconch. Adductor muscle scars ill-defined. White, interior with broad, opaque white ray, widening with growth, at anterior end, posterior end with 2 narrower rays.



Figs 19–21. *Diplodonta (Timothynus) pinnaculum* sp. n. **19**. Paratype, NMSA B8085, off East London, 100 m, coarse sand, length 10.2 mm, height 8.9 mm, LV. **20–21**. Holotype, NMSA C8615, length 10.7 mm, height 9.3 mm, RV. **20**. Interior. **21**. Exterior.

Dimensions: length 10.7 mm, height 9.3 mm, valve depth 3.9 mm (holotype); length 13.5 mm, height 11.8 mm, valve depth 9.0 mm (largest paratype).

Distribution: Continental shelf from northern Zululand to Tsitsikama coast, in about 75–125 m on coarse sand (single valves only).

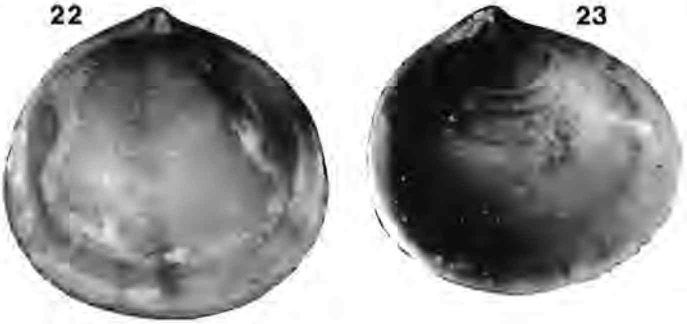
Type material (all NMSA: NMDP unless otherwise stated): Holotype NMSA C8615/T1338, off Whale Rock, Transkei (32°02.9'S; 29°19.7'E), sand and shell rubble, RV. Paratypes: SOUTH AFRICA: *Zululand*: off Boteler Point, 93 m, sand (S9187/T344, 1 RV); off Gipsey Hill, 70–80 m, sandstone rocks, coarse sand (S4612/T1339, 2 LV); off Cape Vidal, 75–80 m, broken shell (E4522/T1343, 1 LV). *Southern Natal*: off Mbizane River, 100 m, coarse sand, some sponge (B9045/T1340, 1 RV); *Transkei*: off Mncwasa Point, 74 m, sand and rubble (C3006/T1342, 1 LV); off Stony Point, 87 m, coarse sand (C4280/T1341, 1 LV). *Agulhas Bank*: off Cape Morgan, 77 fathoms (SAMC A32322, 1 lv); off East London, 100 m, coarse sand, sponge (B8085/T1345, 1 LV); off Cape St Blaize, 125 fathoms (SAMC A32318, 1 RV).

Other material (probably of this species): SOUTH AFRICA: *Western Cape*: False Bay (off Cape Point Lighthouse), 42 fath. (SAMC 32319, 1 LV).

Notes: This species, which appears to be the only *Diplodonta* to occur on the Agulhas Bank, resembles *D. (T.) pseudoglobosa*, but is more vitreous in appearance (apart from several milk-white rays internally), possesses a higher and more swollen umbo, which shows a lunule-like concavity anteriorly, and differs somewhat in hinge characters. The single valve from False Bay may represent an extreme form or a different species: it is much thicker and more opaque, with a slightly lower umbo than typical examples, and is unusually large (length 16.4 mm, height 14.3 mm, valve depth 5.0 mm). More material is needed to resolve its identity.

The raised umbo somewhat resembles that found in *D. ravayensis* Sturany, 1899, of the Red Sea, but that species has a more orbicular outline than *D. pinnaculum*, and is not a *Timothynus*. The umbo is lower than in the East African *D. sansibarica* Jaeckel & Thiele, 1931.

Etymology: *pinnaculum*, Latin noun, neuter, a pinnacle (in reference to the somewhat peaked umbo).



Figs 22–23. *Felaniella subradiata* (Sowerby, 1892) and *F. agulhasensis* (Jaeckel & Thiele, 1931). **22**. Syntype of *Felania subradiata*, part of BMNH 1899.4.14.3483–85, LV, 12.4 x 11.9 mm. **23**. Syntype of *Diplodonta (Felania) agulhasensis*, ZMHB collection, 3.9 x 3.7 mm, LV.

Felaniella Dall, 1899

Type species (o.d.): *Mysia (Felania) usta* Gould, 1861.

Two South African taxa are referable to this genus (and to its subgenus *Zemysia* Finlay, 1926, type species (o.d.) *Lucina zelandica* Gray, 1835). These species are *Felania subradiata* Sowerby, 1892, and *Diplodonta (Felania) agulhasensis* Jaeckel & Thiele, 1931. These were discussed by Barnard (1964: 466–468), who accepted their validity although noting that juveniles were not distinguishable with certainty. Even after examining the large NMSA series of specimens I am unable to decide whether they are indeed distinct, and leave this question in abeyance. Photographs of syntypes of the two taxa are, however, given here.

Felaniella (Zemysia) subradiata (Sowerby, 1892)

Fig. 22

Felania subradiata Sowerby, 1892: 62, pl. 3, fig. 73. Type locality: Port Elizabeth.
Diplodonta (Felania) subradiata; Barnard, 1964: 466, textfig. 21a (references and synonymy).

Type material: Six valves in BMNH 1899.4.14.3483–85, ex Ponsonby.

Felaniella (Zemysia) agulhasensis (Jaeckel & Thiele, 1931)

Fig. 23

Diplodonta (Felania) agulhasensis Jaeckel & Thiele, 1931: 219, pl. 4, fig. 88. Type locality: Agulhas Bank, S. E. of Cape Agulhas (35°26.8'S; 20°56.2'E), no depth given [= 70–80 m on modern charts].

Diplodonta (Felania) agulhasensis; Barnard, 1964: 468, textfig. 21b.

Type material: Two syntypes, comprising one broken adult and a complete juvenile, are in the ZMHB collection.

Microstagon Cossmann, 1896

Type species: *Goodallia herouvalensis* Deshayes, 1860 (s.d. Dall, 1903).

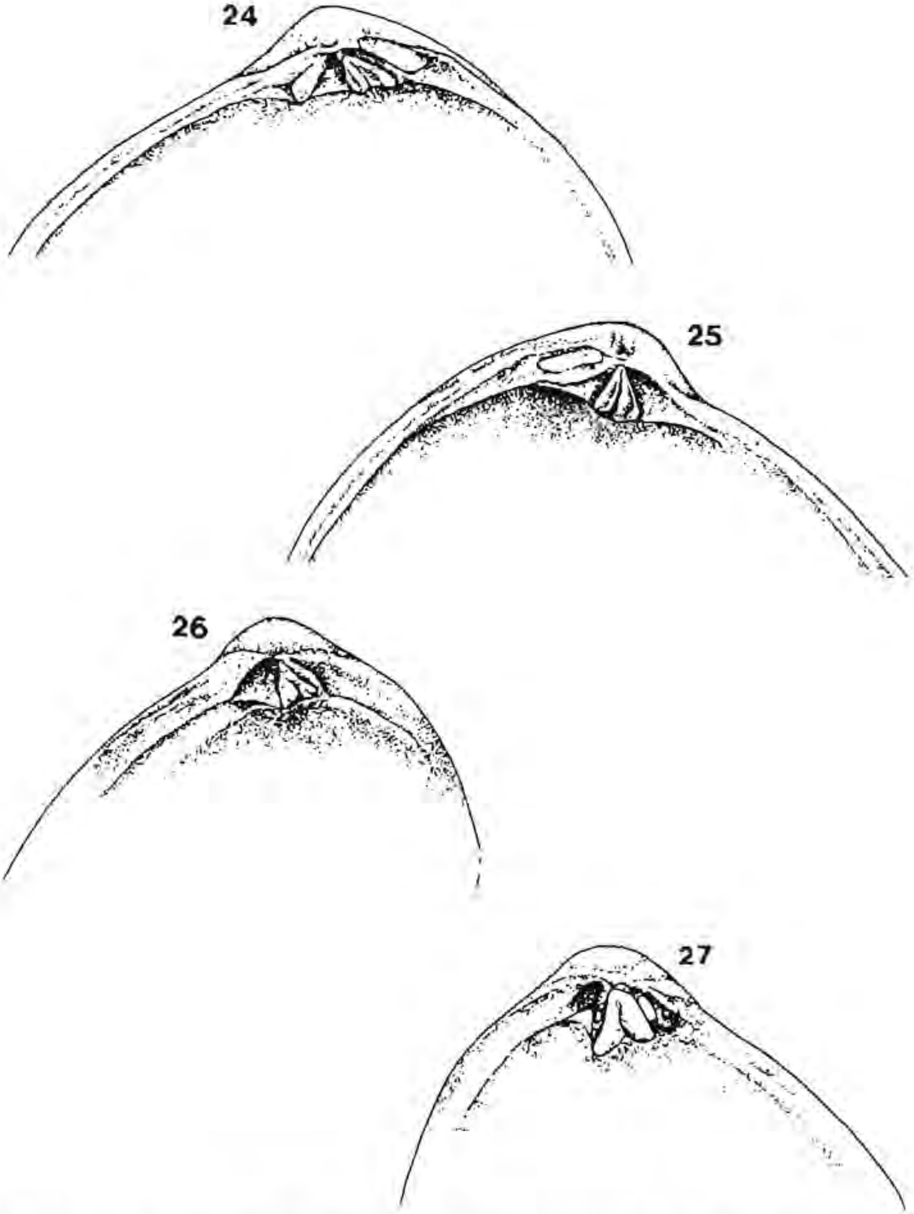
Redefinition (brief): Shell small, outline obliquely-ovate to ovate-trigonal, beaks distinctly prosogyrous, usually slightly posterior to median, anterodorsal margin more or less concave. External surface almost smooth, or with shallow concentric grooves or faint concentric ridges, sometimes also with microscopic radial striae. Periostracum thin and smooth. hinge plate short but moderately deep. Posterior cardinal in each valve triangular and bifid, fitting into a socket on the opposing valve, anterior cardinal simple and oblique in both valves, no lateral teeth. Ligament thin, fairly long and superficial, overlying shorter resilium, situated in a groove. Interior sometimes with faint radial striae. Adductor muscle scars moderately large.

Notes: The systematic position of *Microstagon* was discussed by Chavan (1951) and a definition given by Chavan (in Moore 1969: 517). The genus is well represented in the Paris Basin, but only two Recent species have previously been reported: *M. calculus* (Reeve, 1850) from tropical West America, and *M. japonicum* (Habe,1961) from Japan.

Although Chavan (1969) defined this genus as possessing anterior lateral teeth, Dr Rudo von Cosel (*pers. comm.*, 9.ii.1996) informs me that lateral teeth are absent in the type species and in the other Paris Basin species examined by him. A brief redefinition of the genus is given above; a fuller diagnosis will require study of the fossil taxa, which is far beyond the scope of this paper.

Key to southern African species of *Microstagon*

1 Valves strongly oblique, beaks very blunt, surface with microscopic radial striae; length up to 1.6 mm .... **alfredensis**
– Valves weakly oblique, beaks relatively angular; no radial sculpture externally; length up to about 4.0 mm .... **lacrima**



Figs 24–27. Hinges of *Microstagon lacrima* sp. n and *M. alfredensis* (Bartsch, 1915). 24–25. *M. lacrima*. **24.** RV. **25.** LV. 26–27. *M. alfredensis*. **26.** RV. **27.** LV. Not to scale.

Microstagon lacrima sp. n

Figs 24–25 & 28–30

Description: Shell barely oblique, slightly trigonal-oblong, varying greatly in proportions, but always higher than long (h/l 1.02–1.17) at least when adult, rather compressed (d/l 0.49–0.67), moderately thick, inner margin thinner than elsewhere, bevelled and smooth; beaks rather angular; posterodorsal margin evenly convex, anterodorsal margin slightly concave immediately in front of beak, then convex; postero- and anteroventral margins strongly rounded, ventral margin evenly convex. Hinge moderately short, plate not broad; LV with a bifid anterior cardinal tooth and a low, thin, ridge-like posterior cardinal; RV with a thick, bifid posterior cardinal tooth and a weaker, simple, oblique anterior cardinal; no lateral teeth in either valve; ligament short. Interior of valve often with a feeble radial ridge anteriorly and a faint one posteriorly. Externally smooth, except for low concentric ridges. White or tinged with pale apricot-colour, periostracum thin, glossy, translucent yellowish.

Dimensions: length 3.8 mm, height 4.1 mm, total depth 2.2 mm (holotype); 5.4 x 6.3 mm, valve depth 1,8 mm (largest paratype valve).

Range: Southern Mozambique to Durban Bay, littoral (empty valves only).

Type material: Holotype NMSA L1616/T1321, between Bazaruto and Benguera Is, Mozambique (approximately 21°50'S, 35°27'E), in channel between sandbanks in 3–12 m at HST, dredged R. K., P. & E. Roscoe, August, 1974. Paratypes: MOZAMBIQUE: NMSA K5326/T1322, same data as holotype, 5v; NMSA L184/T1323, Santa Carolina Is., Bazaruto Archipelago, south sandbanks, R. K., 3 + 6v; NMSA G2025/T1324, South Bay, Magaruque Is., Bazaruto Archipelago, E. Roscoe, 1. SOUTH AFRICA: *Natal*: NMSA E1160/T1325, Durban Bay, shallow dredgings, B. J. Young, 11 + 11v.

Additional material: SOUTH AFRICA: *Natal*: Durban Bay, shallow dredgings (NMSA D4850: B. J. Young, numerous).

Notes: *Microstagon japonicum* (Habe, 1961) from Honshu, Japan, is more strongly oblique, and has a thicker hinge plate.

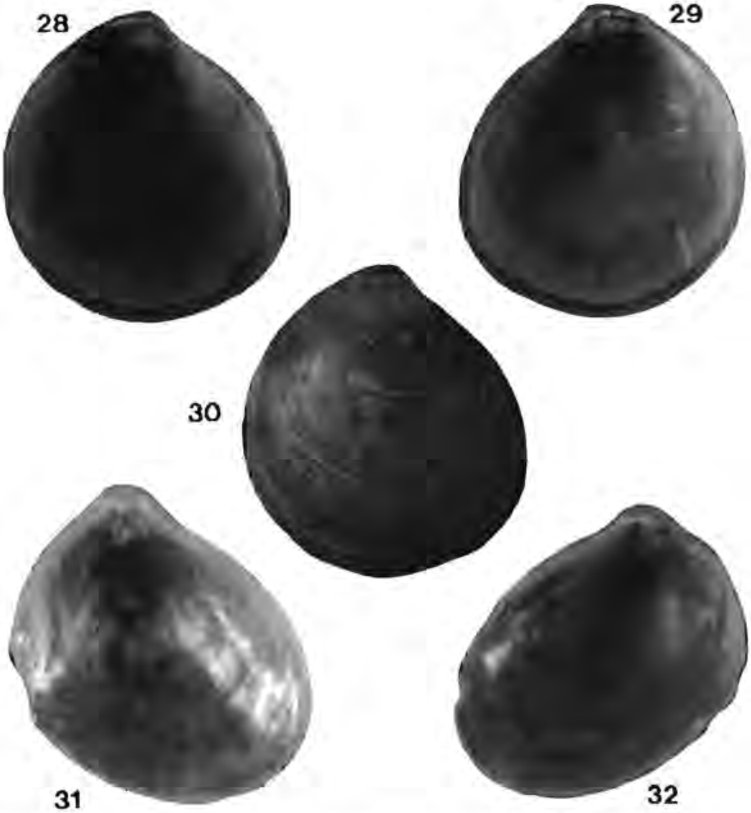
Etymology: *lacrima* = a teardrop, Latin noun.

Microstagon alfredensis (Bartsch, 1915)

Figs 26–27 & 31–32

Felaniella alfredensis Bartsch, 1915: 195, pl. 48, fig. 5; pl. 53, figs 7, 8; Turton, 1932: 236; Thiele & Jaeckel, 1931: 62 (220). Type locality Port Alfred.

Description: Shell strongly oblique, slightly trigonal-oblong, height and length more or less equal, rather compressed, moderately thick, inner ventral margin not bevelled, smooth; beaks very blunt; posterodorsal margin evenly convex, anterodorsal margin slightly concave immediately in front of beak, then gently convex; anteroventral margin strongly rounded, posteroventral one much less so; ventral margin asymmetrically convex. Hinge short, plate declivous, not broad; LV with a strong, erect, bifid anterior cardinal tooth, posterior cardinal obsolete, little more than a slight projection from dorsal margin; RV with a triangular, bifid posterior cardinal tooth, which is obliquely inclined posteriorly and is lower with less divergent limbs than that of LV, and traces of a vestigial, simple anterior cardinal near and parallel to dorsal margin; no lateral teeth in either valve; ligament moderately short. Interior of valve without radial ridges. Externally smooth, except for faint, microscopic radial striae and weak concentric striae. White.



Figs 28–32. *Microstagon lacrima* sp. n. and *M. alfredensis* (Bartsch, 1915). **28–30**. *M. lacrima*: holotype NMSA L1616, length 3.8 mm, height 4.1 mm. **28**. Interior of LV. **29**. Interior of RV. **30**. Exterior of RV. **31–32**. *M. alfredensis*, USNM 1561. **31**. Holotype, LV interior, length and height 1.5 mm. **32**. Paratype, RV interior, length 1.5 mm, height, 1.6 mm.

Dimensions: holotype (LV) height 1.5 mm, length 1.5 mm, paratype (RV) height 1.6 mm, length 1.5 mm.

Types: Holotype (LV) and paratype (RV) USNM 1561. Although Bartsch referred to the latter only as 'another specimen', its hinge was also figured, giving it paratype status.

Distribution: Known only from beach-worn valves from the littoral of Port Alfred and a fragment from the Agulhas Bank, S. E. of Cape Agulhas (35°26.8'S; 20°56.2'E), no depth given [= 70–80 m on modern charts].

Notes: This species is extremely rare, and other than the types I have seen only two valves, both in the Turton collection in OXUM. All are worn, and ligamental details need to be established from fresh examples.

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REFERENCES

BARNARD, K. H. 1964. Contributions to the knowledge of South African marine Mollusca. Part V. Lamellibranchiata. *Annals of the South African Museum* **47** (3): 361–593.

BARTSCH, P. 1915. Report on the Turton collection of South African marine mollusks, with additional notes on other South African shells contained in the United States National Museum. *Bulletin of the United States National Museum* **91**: i–xii, 1–305, pls 1–54.

CHAVAN, A. 1969. Family Ungulinidae. *In*:Moore, R. C., ed., *Treatise on Invertebrate Palaeontology* Part N. **2**. Mollusca **6**. New York: Geological Survey pp 514–517.

HABE, T. 1961. Descriptions of fifteen new species of Japanese shells. *Venus* **21** (4): 416–431.

KILBURN, R. N. & TANKARD, A. J. 1975. Marine Mollusca from Cape Pleistocene deposits. *Annals of the South African Museum.* **67** (6): 183–226.

LAMY, E. 1921. Révision des Lucinacea vivants du Muséum d'Histoire Naturelle de Paris. *Journal de Conchyliologie* **65** (4): 335–388.

ODHNER, N. H. 1918. Contribution à la faune malacologique de Madagascar. *Arkiv för Zoologi* **12** (6): 1–52, pls 1–4.

SMITH, E. A. 1876. Diagnoses of new species of Mollusca and Echinodermata from the Island of Rodriguez. *Annals and Magazine of Natural History* [4] **17**: 404–406.

——— 1877. Mollusca [of Rodriguez Island]. Account of the petrological, botanical and zoological collections made in Kerguelen's Land and Rodriguez during the 'Transit of Venus' expeditions in the years 1874–5. *Philosophical Transactions of the Royal Society* **168**: 473–484, pl. 51.

——— 1903. List of species of Mollusca from South Africa, forming an appendix to G. B. Sowerby's "Marine shells of South Africa". *Proceedings of the Malacological Society of London* **5** (6): 354–402, pl. 15.

SOWERBY, G. B. 1892. *Marine shells of South Africa. A catalogue of all the marine species, with references to figures in various works, descriptions of new species, and figures of such as are new, little known, or hitherto unfigured.* London: Sowerby.

THIELE, J. & JAECKEL, S. 1931. Muscheln der Deutschen Tiefsee Expedition. *Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition 'Valdivia'.* Jena: Gustav Fischer. **21**: 3–110 (161–268), pls. i–v (vi–x).

TURTON, W. H. 1932. *The marine shells of Port Alfred, South Africa.* London: Oxford University Press pp i–xvi, 1–331, pls 1–70.

YARON, I., SCHIØTTE, T. & WIUM-ANDERSEN, G. 1986. A review of molluscan taxa described by P. Forsskål and C. Niebuhr with citation of original descriptions, discussion of type-material available and selection of some lectotypes. *Steenstrupia* **12** (10): 157–203.

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